



Department of Pesticide Regulation



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MEMORANDUM

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HSM-12002

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(original sign by H. Fong)

DATE: January 31, 2012

SUBJECT: RESULTS FROM AIR MONITORING A TARPAULIN CUTTING AND
REMOVAL OPERATION INVOLVING 5-LAYER TOTALLY IMPERVIOUS
FILM TARPAULIN ON A CHLOROPICRIN-TREATED FIELD

On September 30th, 2011, Worker Health and Safety (WHS) industrial hygienists and scientists traveled to Watsonville, Santa Cruz County to conduct an air monitoring study on potential airborne exposure to workers involved in cutting and removing field tarpaulin. The flat field had been treated the week before (September 24th) with chloropicrin (Tri-Chlor, EPA Reg. # 58266-2-11220), shanked in conjoined field sites at two different rates: 300 lb./acre and 350 lb./acre. Both sites were 5 acre parcels. A five layer laminate film was used to tarp the field. This film was identified as VaporSafe™ brand, a totally-impervious film (TIF) manufactured by Raven Industries. The use of TIF tarpaulin reduces fumigant escaping into the general air environment surrounding the treated field. However, this same retention property could also expose tarpaulin cutters and removers to potentially higher levels of fumigant during their handling operations. Greater concentration under TIF tarpaulins might be released by the initial cutting of the tarpaulin and panels left on the field may hold the higher gas concentrations until the tarpaulin removal crew pulls them off the field. To investigate this possibility, air monitoring had been scheduled to be conducted at the field site. However, on early arrival to the field, this was not the case.

WHS scientists were initially notified that the TIF tarpaulin on the field would be cut on the morning of October 1, 2011 (permit conditions required cutting at 7 days after application). Frank Schneider, Associate Industrial Hygienist and Bernie Hernandez, Research Scientist I, traveled to the site on September 30 to conduct a pre-activity assessment of the environment. They found that a tarp cutting crew was on site and preparing to cut the TIF tarpaulin, even though the field posting plainly stated that the restricted reentry interval expired on October 1 (see Photo One). Lacking authority to prevent the tarpaulin from being cut, scientists quickly unpacked and deployed the necessary monitoring equipment. Two MSA ELF air pumps, one set for 1.5 liters per minute (lpm), the other for 2 lpm, were connected to XAD-4 sampling media and situated on the all-terrain-vehicle cutter rig such that the air samples were drawn from the same level as the operator's breathing zone (Photo Two). Two different sampling rates were used since the ELF's were found not capable of running dependably at 2 lpm. The reduction of sampling rate was carried out through the rest of the study. This would have no effect on the

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sampling results, since there is no critical volume limit, as methyl bromide sampling has. The cutting operation took 38 minutes.

After the cutting, scientists were told that TIF tarpaulin removal would begin at approximately 1300 hours the following day.



Photo One: Reentry Interval Posting



Photo Two: Cutting rig with air monitoring equipment

The next day, all WHS research staff arrived at the field at 1100 hrs. Though previous arrangements between the tarpaulin removal company and WHS research staff had set 1300 hours as the start time for TIF tarpaulin removal, the removal crew was already on site and ready to begin work, so WHS staff rapidly deployed the necessary sampling equipment. Two tractors (designated “A” and “B”) were used to gather up the cut TIF tarpaulin panels and twist them into easier-to-handle “ribbons” (Photo Three). These ribbons remained in the field for other crew members, who were on foot, to tie together to form an endless ribbon (Photo Four). Finally, the ribbon was fed into a flat-bed truck situated on the perimeter of the field. The gathering device had two rubber wheels that pulled the ribbons into the truck bed, where the operator would then tamp the ribbons down (Photo Five).



Photo Three: Tractor gathers panel, twists panel and leaves ribbon



Photo Four: Ribbon tying



Photo Five: Gathering of ribbon into truck

Air monitoring units, such as were used for cutter sampling, were placed to collect air from the worker's breathing zone or a representative air parcel. The two tractor drivers' air monitors were located on the roll-over-protection bar just behind the driver's back, one on each side (right and left) of the vehicle. The first set of these (approximate time period 1130 to 1215 hours) were

changed, as per protocol, at approximately 40 minutes. The second set (approximate time period 1230 to 1300 hours) were shorter, since the worker completed their task of twisting the tarpaulins. The collection truck was equipped with two air monitoring pumps at the following locations: within the driver's cab; on the rear of the truck, level with the flat bed; and on the work platform over the cab, sampling the air parcel of the person operating the gathering device. These samples ran for approximately 50 minutes. The tubes were not changed at 40 minutes since the gathering task was almost complete and a second set of sample would have only ran for possibly 8 minutes, had the tubes been changed. One opportunity sampling site (i.e. not in initial protocol) was established in the field itself, approximately 25 meters into the field from both adjoining sides, configured such that it sampled air approximately 1 meter from the soil surface. This would be useful in representing potential exposure to the "ribbon tier".

It was noted that all the work crew members were wearing 3M elastomeric respirators equipped with what appeared to be 3M Brand chemical cartridges, #60928. These are the appropriate respiratory protection for handlers performing tarp cutting and tarp removal activities in fields treated with methyl bromide, according to Title 3 California Code of Regulations, Section 6784. Sampling results are shown in Table One.

Location	Flow (l/min)	Time Span (clock time)	Time Total (min)	ug/sample	Total Liters	mg/m3	ppBillion
Cutter	1.5	1125-1203	38	6.45	57	0.113	16.8
Cutter	2	1125-1203	38	5.05	76	0.066	9.9
<i>Tractor Driver A</i>	<i>1.5</i>	<i>1134-1215</i>	<i>41</i>	<i>17</i>	<i>61.5</i>	<i>0.276</i>	<i>41.1</i>
<i>Tractor Driver A</i>	<i>1.5</i>	<i>1133-1214</i>	<i>41</i>	<i>21.6</i>	<i>61.5</i>	<i>0.351</i>	<i>52.2</i>
Tractor Driver B	1.5	1135-1213	38	11.2	57	0.196	29.2
Tractor Driver B	1.5	1135-1212	37	15.5	55.5	0.279	41.5
<i>Tractor Driver A</i>	<i>1.5</i>	<i>1235-1257</i>	<i>22</i>	<i>3.49</i>	<i>33</i>	<i>0.106</i>	<i>15.7</i>
<i>Tractor Driver A</i>	<i>1.5</i>	<i>1235-1259</i>	<i>24</i>	<i>9.11</i>	<i>36</i>	<i>0.253</i>	<i>37.6</i>
Tractor Driver B	1.5	1240-1301	21	10.8	31.5	0.343	51.0
Tractor Driver B	1.5	1240-1302	22	12.7	33	0.385	57.2
<i>Truck Driver</i>	<i>1.5</i>	<i>1204-1254</i>	<i>50</i>	<i>0.409</i>	<i>75</i>	<i>0.005</i>	<i>0.8</i>
<i>Truck Driver</i>	<i>1.5</i>	<i>1204-1254</i>	<i>50</i>	<i>0.22</i>	<i>75</i>	<i>0.003</i>	<i>0.4</i>
Receiver Loader	1.5	1204-1256	52	2.14	78	0.027	4.1
Receiver Loader	1.5	1204-1255	51	0.551	76.5	0.007	1.1
<i>Flat Bed</i>	<i>1.5</i>	<i>1204-1252</i>	<i>48</i>	<i>1.83</i>	<i>72</i>	<i>0.025</i>	<i>3.8</i>
<i>Flat Bed</i>	<i>1.5</i>	<i>1204-1253</i>	<i>49</i>	<i>4.32</i>	<i>73.5</i>	<i>0.059</i>	<i>8.7</i>
Field Sample 1m	1.5	1200-1240	40	2.76	60	0.046	6.8

Table One: Chloropicrin air monitoring results

The results were universally low, with the highest value detected, 57.2 ppb, found on one of the tractor drivers. These results all compare favorably to the Cal/OSHA Permissible Exposure Limit (PEL) of 100 ppb. Inasmuch as the PEL is a time weighted average (TWA) value, the TWA values for these work activities within the characterized air parcels was calculated. Table Two shows the calculated TWA. TWAs are calculated as follows:

$$TWA_e = (C_a T_a + C_b T_b + \dots C_n T_n) \div 480$$

Where:

TWAE is the equivalent time weighted average exposure for the 8-hour working shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in minutes of the exposure at the concentration C.

The TWA values assume that after completing their activities at the field, the workers would have no further detectable exposure to chloropicrin and thus zero values for the time they were not actively working at this site.

Location	Average ppb	Time (minutes)	8-hour TWA (ppb)
Cutter Rig	13.4	38	1.06
Tractor A	46.7	41	5.3
	26.7	23	
Tractor B	35.4	38	5.3
	54.1	22	
Truck Cab	0.6	50	0.1
Receiver Loader	2.6	52	0.3
Flat Bed	6.3	49	0.6
Field Sample 1m	6.8	40	0.6

Table Two: 8-hour Time Weighted Average

Environmental conditions were not ideal for air sample collection. Though temperature was in the mid-70's, winds were constant. The Kestrel 3000 weather gauge indicated wind speeds from 12 to 16 miles per hour, with gusts up to 22 miles per hour. Such windy conditions tend to sweep away any gasses trapped under the TIF tarpaulin and also entrain and remove any emissions actively coming from the field. This study should not be considered representative of potential exposure conditions for persons working in calmer wind conditions.

Since the samples were taken under conditions that would tend to rapidly remove any emissions from the field location, use of this data to draw definitive conclusions as to worker exposure is not advised. Further testing, under more stable weather conditions is advised. Furthermore, the label allows removal of TIF tarpaulin from chloropicrin-treated fields is allowed at shorter intervals than were used here. Any additional studies of TIF-tarp behavior on chloropicrin-treated fields should be done at both the maximum use rate and the shortest allow time intervals, both between treatment and cutting and between cutting and TIF-tarp removal.